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Hard Mast Survey
Great Smoky Mountains National Park

## Introduction

Hard mast is the most important fall food for wildlife in Great Smoky Mountains National Park (GRSM). Annual variations in hard mast production affect food habits, movements, habitat preference, reproduction, and, therefore, density of black bears (*Ursus americanus*) in GRSM (McLean 1991). Hard mast also is an important fall food for other wildlife species including white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), chipmunks (*Tamias striatus*), squirrels (*Sciurus carolinensis, Tamiasciurus hudsonicus*), wild hogs (*Sus scrofa*), and elk (*Cervus elephas*).

Since 1979, hard mast surveys have been used to collect baseline information for assessing and monitoring mast production in GRSM (Nicholas and White 1984). The following report summarizes the 2008 hard mast survey. The following personnel assisted with the 2008 hard mast survey: Jared Beaver, Jay Carr, Dani Cessna, Bill Stiver, Rick Varner, Bobby Watson and Joe Yarkovich.

## Methods

Visual surveys (Whitehead 1969) were used to determine the availability and distribution of hard mast. Thirty-four 6.4-km (4.0-mi.) survey routes established in previous years were resampled in 2008. Trees marked with aluminum tags were located using 7.5 minute U.S. Geological Survey topographic maps and a Garmin portable GPS receiver. For each tree sampled, data regarding location, diameter at breast height and species were recorded. Using binoculars, the crown of each tree was surveyed for approximately 30 seconds and an estimate of the percent of visible crown with mast was determined. Using Microsoft Access, mast survey indices were calculated using methods developed by Greenberg and Warburton (2007). Index values $\leq$ 2.00 were classified as poor, 2.01 to 3.00, fair, and $\geq$ 3.00, good (Wentworth 1989). Although a variety of hard mast trees occur in the GRSM (Table 1), only oak trees (*Quercus spp*.) were surveyed since they are considered the most important mast producing trees (Nicholas and White 1984).

## Results

The 2008 hard mast survey was conducted from 6 August to 29 August. A total of 523 trees, representing nine oak species were surveyed (Table 1). The mast index value for all oaks was 1.79 indicating poor abundance. White oak and red oak index values were 0.99 and 2.10, respectively (Table 2) suggesting poor and fair abundance for each species group.

## Discussion

Although the mast index value suggested poor acorn abundance, red oak trees in higher elevations produced very well, whereas the abundance of most species in the lower elevations

was poor. Because of a high density of bears in the Park and spotty acorn abundance, it appeared that some bears were not finding adequate food in late summer and fall, resulting in a significant increase in nuisance activity. In fact, from early August to mid October, there were two attacks on humans and multiple incidences of property damage from bears. In addition, two bears were euthanized due to aggressive behavior, eight backcountry campsites were closed, and 19 locations were posted with bear warning signs.

The abundant and concentrated red oak mast in the higher elevations will likely impact winter hog control efforts. Park wildlife personnel anticipate wild hogs will also be concentrated in the less accessible higher elevations during winter, making their control efforts much more logistically challenging.

Modifications

A few untagged trees were surveyed to replace trees that were missing tags, damaged or had fallen.

Only oak trees were surveyed. All non-oak trees were omitted from the survey.

Suggestions for Future Surveys

Some aluminum tags established on trees in previous years need to be replaced.

Literature Cited

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Wentworth, J. M. 1989. Deer habitat relationships in the Southern Appalachians. Ph.D. Dissertation. University of Georgia, Athens. 100pp.

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Table 1. Major hard mast trees of Great Smoky Mountains National Park (Nicholas and White 1984).

| Common Name | Scientific Name |
|---|---|
| **WHITE OAKS** | |
| White Oak (84)[1] | Quercus alba |
| Chestnut Oak (119) | Quercus prinus |
| Post Oak (1) | Quercus stellata |
| Chinkapin Oak (0) | Quercus muehlenbergii |
| Overcup Oak (0) | Quercus lyrata |
| **RED OAKS** | |
| Northern Red Oak (192) | Quercus rubra |
| Southern Red Oak (7) | Quercus falcata |
| Scarlet Oak (69) | Quercus coccinea |
| Black Oak (46) | Quercus velutina |
| Shingle Oak (3) | Quercus imbricaria |
| Blackjack Oak (0) | Quercus marilandica |
| Pin Oak (2) | Quercus palustris |
| Unidentified Red Oak (0) | Quercus spp. |
| **HICKORIES** | |
| Bitternut Hickory (0) | Carya cordiformis |
| Mockernut Hickory (0) | Carya tomentosa |
| Shagbark Hickory (0) | Carya ovata |
| Pignut Hickory (0) | Carya glabra |
| Shellbark Hickory (0) | Carya laciniosa |
| Sweet Pignut Hickory (0) | Carya ovalis |
| Sand Hickory (0) | Carya pallida |
| Unidentified Hickory (0) | Carya spp. |
| **WALNUT** | |
| Black Walnut (0) | Juglans nigra |
| Butternut (0) | Juglans cinerea |
| **BEECH** | |
| American Beech (0) | Fagus grandifolia |

[1]Number in parentheses indicates sample size for the 2008 hard mast survey.

Table 2. Hard mast indices (Greenberg and Warburton, 2007) for Great Smoky Mountains National Park, 1979-2008.

| Year | White Oak | Red Oak | Total Oak |
|---|---|---|---|
| 1979 | 4.33 (59)[1] | 3.19 (61) | 3.91 (120) |
| 1980 | 0.78 (52) | 4.00 (74) | 2.87 (126) |
| 1981 | 3.86 (65) | 2.32 (88) | 3.11 (153) |
| 1982 | 0.67 (47) | 2.23 (82) | 1.79 (129) |
| 1983 | . | . | . |
| 1984 | . | . | . |
| 1985 | 2.60 (77) | 1.90 (83) | 2.34 (160) |
| 1986 | 1.60 (79) | 3.04 (93) | 2.53 (172) |
| 1987 | 2.94 (99) | 2.62 (116) | 2.91 (215) |
| 1988 | 2.96 (77) | 3.21 (166) | 3.33 (243) |
| 1989 | 0.66 (75) | 3.08 (160) | 2.49 (235) |
| 1990 | 1.25 (103) | 1.61 (112) | 1.53 (215) |
| 1991 | 1.35 (99) | 1.05 (147) | 1.24 (246) |
| 1992 | 0.50 (112) | 0.85 (155) | 0.76 (267) |
| 1993 | 0.45 (95) | 2.67 (155) | 1.98 (250) |
| 1994 | 0.79 (118) | 2.20 (142) | 1.68 (260) |
| 1995 | 1.97 (99) | 5.04 (167) | 4.16 (266) |
| 1996 | 3.94 (102) | 1.87 (156) | 2.81 (258) |
| 1997 | 0.66 (97) | 2.76 (165) | 2.14 (262) |

Table 2. Continued.

| Year | White Oak | Red Oak | Total Oak |
|---|---|---|---|
| 1998 | 1.73 (81) | 3.77 (171) | 3.33 (252) |
| 1999 | 1.23 (105) | 1.29 (150) | 1.35 (255) |
| 2000 | 0.78 (87) | 1.61 (163) | 1.42 (250) |
| 2001 | 1.05 (92) | 5.10 (165) | 3.92 (257) |
| 2002 | 0.97 (188) | 2.38 (317) | 1.99 (503) |
| 2003 | 0.99 (214) | 0.80 (312) | 0.94 (526) |
| 2004 | 2.62 (177) | 2.25 (331) | 2.52 (508) |
| 2005 | 0.48 (201) | 2.24 (329) | 1.70 (530) |
| 2006 | 0.80 (198) | 1.33 (315) | 1.21 (513) |
| 2007 | 2.00 (207) | 1.67 (321) | 1.91 (528) |
| 2008 | 0.99 (204) | 2.10 (319) | 1.79 (523) |

[1]Number in parentheses indicates sample size for each group of trees.